Craig & Tilden. Experiments reported. 1872.

REPORT

ON THE

PRESERVATION OF WOOD,

BY

GEN. J. K. BARNES, SURGEON-GENERAL, U. S. A.
GEN. A. A. HUMPHREYS, CHIEF OF ENGINEERS, U. S. A.
GEN. M. C. MEIGS, QUARTERMASTER-GENERAL, U. S. A.
GEN. O. E. BABCOCK, COM'R PUBLIC BUILDINGS AND GROUNDS.

TO THE

BOARD OF PUBLIC WORKS

OF THE

DISTRICT OF COLUMBIA.

WITH TABULATED RESULTS OF AN EXAMINATION OF ALL THE BEST KNOWN METHODS, CONDUCTED BY

DR. B. F. CRAIG, A. A. SURGEON, U. S. A.

AND

DR. W. C. TILDEN, A. A. SURGEON, U. S. A.

AT THE LABORATORY OF THE SURGEON-GENERAL'S OFFICE.

WASHINGTON, D. C.

1872.

WAR DEPARTMENT, SURGEON-GENERAL'S OFFICE,
WASHINGTON, D. C., *May* 8, 1872.

Hon. A. R. SHEPHERD:

Sir.—I have the honor to transmit herewith the report on different processes of preserving wood, with result of very thorough and careful experiments, made by Doctors Craig and Tilden in the laboratory of this office.

Very respectfully,

Your obedient servant,

J. K. BARNES.

(A true copy.)

EDWARD JOHNSON,

Chief Clerk.

MAY 7th, 1872.

General J. K. BARNES, U. S. A.:

Sir.—The examination of the paving-blocks sent to this office by the Board of Public Works, has been conducted by A. A. Surgeon Tilden, U. S. A., to whose report, with the accompanying tables and diagrams, I have the honor to refer for detailed information.

The specimens submitted were of two kinds: *Firstly*, those impregnated with mineral antiseptics, of which the Burnettized blocks may be taken as a type; and, *Secondly*, those in which the impregnation has been with certain organic liquids—hydrocarbons and resinous oils—substances whose efficacy, over and above the strictly antiseptic qualities of some of them, depends on their possession of the physical

properties of oils, and their consequent power of excluding water—the most essential agent in the decomposition of wood.

The chemical researches have been directed toward the determination of the nature, the extent and uniformity of the impregnation of the wood, and of the extent to which the wood has been rendered impermeable to water. The question of the efficacy of any particular impregnation, when thoroughly made, is one which is rather to be decided upon by the civil engineer, from the results of experience, than by the investigations of the laboratory.

In the case of the first-named class of blocks—those of mineral impregnation—it is probable that the Burnettized process will be accepted as the one whose value is the best established by experience.

In regard to blocks of the second class, our experiments can, perhaps, furnish rather more positive guidance to the engineer, and in this connection, attention is called to the Diagram marked "D," on which is represented, graphically, the results of those experiments which are considered to have the most important bearings. The chief line of the Diagram (that in black ink) represents the amounts of water absorbed by different blocks, after immersion for forty-eight hours, the absorption being hastened by the use of the air-pump. It will be seen that the woods impregnated with oil, took up amounts of water varying from two and nine-tenths per cent. to twenty-four and three-tenths per cent.; while the woods of mineral impregnation absorb much larger, but widely varying amounts. As connected with the power of excluding water, the amounts of oily matter found in the block has been represented on the same diagram—that from the centre of the blocks, in blue, and that from the outside in red ink—so that both the extent and the uniformity of the impregnation are presented to the eye. It may be remarked, that the six blocks which absorb the least amounts of water, and are the most thoroughly impregnated with oils, belong to only two sets of specimens, four of them being samples of the results of the *Seely* process, in which the wood is immersed at a temperature of 250° F. in a bath of the "dead oil" of commerce; an oil which is strongly antiseptic from

the presence of carbolic and cresylic alcohols, &c. The other two specimens, Nos. 3 and 13, belong to an undescribed process, in which impregnation seems to have been made with resin oil, and the result of the treatment has unfortunately been to weaken very much the fibres of the wood, and to give it a tendency to wear away by friction.

One of the blocks presented, may be described as hardly belonging to either of the classes above spoken of. The protection given to the block is a mechanical one, viz.: the covering of the block with asphaltum. To make this protection efficacious, the covering on the upper side of the block should be harder and more tenacious than it appears to be in the specimen submitted. In the cases of some of the mineral impregnations, chiefly those where two fluids have been used in succession, the process appears to have failed from mechanical difficulties, which may, in future trials, be overcome, but which exclude the present samples from the possibility of successful competition.

I have the honor to remain,

Very respectfully yours,

(Signed), B. F. CRAIG,

A. A. Surgeon, U. S. A.

MEMORANDA

OF

EXPERIMENTS ON SOME WOOD-PRESERVING PROCESSES.

LABORATORY, SURGEON-GENERAL'S OFFICE,
May 4th, 1872.

The problem of wood-preservation is to be considered from two stand-points, according to the use to be made of the wood after treatment, because the decay of wood fibre has two distinct causes. "Dry rot," or that form of decay which occurs in wood exposed to atmospheric influences alone, is due to the development of certain fungous germs which exist in all organic tissues, and which depend upon warmth and moisture for their growth and destructive effects. "Wet rot" is understood to be caused by those fermentative

changes consequent upon alternate wetting and drying, which take place in the albuminous substances which encrust the ligneous cells and fill the cellular tissue. Timber which is entirely submerged does not decay. Free access of oxygen, and a degree of warmth, above the mean temperature of large bodies of water, are needed.

The conditions of the first subdivision of the problem are comparatively simple. It is easy to guard vegetable albumen against ordinary causes of change, by substances which coagulate it, without afterwards deliquescing, and simultaneously employing a temperature sufficient to destroy all germs of organic life which the wood may contain. Where wood is thoroughly impregnated by a proper antiseptic, at a temperature of at least 250° F., there is reason to believe that it may last indefinitely in a dry atmosphere. Even seasoning alone, when carefully managed, appears to have rendered wood indestructible under these circumstances. But when it is to be exposed to the action of a powerful solvent—as natural waters, which are alkaline in reaction, and especially if air and water act alternately upon it—the difficulties multiply amazingly. Few substances known to chemistry are capable, at the same time of solution, so as to saturate the wood, of non-liability to absorb aqueous moisture, and of insolubility in all the liquids which may act upon wood when laid in pavement, or otherwise dangerously exposed. The experiments made illustrate the truth of this brief preliminary note.

The specimens submitted, are to be divided into two principal classes. The first includes those which are treated with solutions of mineral or metallic salts. Nos. 2, 5, 8, 9, 14, 16, 17, 19, 21. The second embraces those blocks which have been more or less thoroughly impregnated with hydrocarbon substances, Nos. 1, 3, 4, 6, 7, 10, 11, 12, 13, 15, 20, and 22. The claims of the first class are either (1.) the protection of the vegetable albumen encrusting the cells of woody fibre, and the destruction of fungoid germs, by the presence of an antiseptic material; or, (2.) the filling or occlusion of the visible pores, after coagulation of the more readily fermentable matters has been induced. Some defects of these processes are shown by the experiments. *First*—The fact that

the preserving fluids, having originally been aqueous solutions, are readily withdrawn from the wood by the action of water. *Second*—In most instances, the character of the chemicals used, is such, as to attack the cell walls as well as their more unstable contents, thus lessening their mechanical strength, and predisposing to decay, when circumstances favor; and *Third*—In those processes which design to fill the pores of the wood with insoluble substance (formed by a re-arrangement of several chemical compounds), the reaction which occurs is only partial, and confined to the superficies, being hindered by the formation of the insoluble salt, at and near the surface. An inspection of the columns of density and weight, in the case of No. 16, will illustrate this statement. The aim of this process seems to be the formation of a kind of artificial stone within the wood cells. It would be less expensive and more feasible, to use larger and removable moulds, instead of tubes, or inter-cellular spaces, which are generally less than $\frac{1}{200}$ inch in diameter.

I have failed to verify some results published by chemists, in the examination of wood treated by this class of preservative agents. My experiments show, that it is always *possible* to dissolve, and remove entirely, any mineral or metallic salt which may have been deposited, with any great degree of thoroughness, throughout a paving-block. Slightly acidulated water, acting upon raspings of Burnettized spruce, removes every trace of zinc. I also notice the, at least, partial decomposition of the salt, the first portions of pure distilled water used for washing, containing chlorine, but yielding no reaction for zinc. Microscopical examination of sections of each of the specimens of this class, shows that the impregnation is not complete. The appearances observed indicate that the liquids used did not possess the "wetting property," but that when forced into the wood, instead of evenly adhering to the cell walls, they tend to cohere in minute globules, usually separated from each other by several diameters of the long cells.

Block No. 17 contains arsenic; and block No. 14 claims its use. The danger incurred by the workmen employed in preparing wood by these processes, long ago led to their abandonment. Arsenic is also gradually soluble in the

surface-water of streets, and possibly will prove seriously injurious, as dust, when borne by the winds into human lungs and dwellings.

Without mentioning each specimen of this class, further than to call attention to the figures obtained by experiment, I note, that as they do not exclude water (as a class), even as perfectly as natural wood, they cannot be advantageously employed for pavement purposes; also, that the chemicals used injure the strength of wood-fibre materially, and that the dust from such pavements cannot improve the public health. Admitting that dry rot can be delayed by such treatment of wood, more than this cannot be justly claimed.

The blocks of the second class—those treated with hydro-carbon fluids or vapors—present some interesting specimens of the recent improvements in the art of preserving wood. They comprise: (1.) The saturation of the wood by a solution of common resin, or by resin-oil; (2.) by the vapor of creosote-oil; and, (3.) by the direct application of "dead," or creosote oil by an ingenious management of the temperatures of two oil baths. All claim the withdrawal of the sap, its replacement by the material used (whether liquid or gaseous), and the destruction of organic germs, together with the coagulation of nitrogenous matters.

Nos. 3 and 13 are soaked in "resin" oil (one of the last products of the destructive distillation of resin.) Their small size has enabled them to be very completely filled by the oil, thus reducing absorptive power, and increasing their density. From my own experience, I do not hesitate to doubt the possibility of securing an impregnation equal to these small samples, upon large pieces of wood, unless very powerful machinery is employed. The character of woody fibre seems in them almost lost. They cut more like wax than like wood. When broken, the fracture is abrupt and clean, and the fibre bears very little strain. The water in which their absorptive power was tested, was filled with globules of oil, and fragments of partially disintegrated woody fibre, not removed by abrasion, or by any mechanical agitation.

No. 11 is soaked in a bath made by dissolving resin in gasolene, or naphtha. It exhibits some of the peculiarities of Nos. 3 and 13, though in a much less marked degree. The

impregnation is not so complete, but was apparently effected at a much lower temperature, and with less injury to the cell-walls Common resin is not a very reliable substance. It is a mixture of two acids (sylvic and pinic), which are saponifiable, and is, therefore, exposed to the danger of gradual solution in water which is even slightly alkaline. It contains no antiseptic principle recognized as such, and can only be said to act as a wood preservative, in so far as it excludes water. There is also difficulty in its economical use, without greatly injuring the texture of the wood.

No. 1 is an anomalous instance of saturation by a solution of chloride of sodium, followed by a bath of "dead oil of tar." Neither of the liquids has penetrated far into the block, as columns 3, 4, 5 and 6 show—and the absorptive power of the wood is high. Nos. 10 and 20, also 15, have been subjected to the vapor of "dead oil." The Robbins' process (Nos. 10 and 20), is thus described by the inventor: "At 300° F., the vapor of naphtha passes over. This drives the air out of the chamber, and out of the pores of the wood. At 350° to 400° of heat, carbolic acid, or creosote, is generated; this permeates the blocks thoroughly, and furnishes an antiseptic which will prevent fermentative putrefaction or decay. At about 500° F., the heavy oils are vaporized. They condense in the wood—that is, prime it—and thus furnish to the fabric complete resistance to the moisture of the atmosphere."

No. 15 is prepared by a process which is inferior, though similar to this.

Nos. 4, 6, 7, 12 and 22 are specimens of the "Seely process," which "consists in enclosing the wood to be treated in a cylinder of iron, which is filled with creosote oil. Heat is then applied by means of a steam coil, to such a degree (250° F.) as to vaporize the sap, which passes off through a dome, to a condenser. When the condenser no longer shows the flow of sap, the pores are free from water, and contain only steam. The hot bath is now quickly replaced by a cold bath of the same oil, which condenses the steam in the pores, and the cold oil is forced into the wood by atmospheric pressure, assisted by capillary action." A reference to the experimental results, shows some important differ-

ences between the blocks prepared by the vapor process and those which have been saturated by the oil itself, by the above method.

The former are far more porous, absorb many times more water, and yield much smaller percentages of oleaginous matters to solvents than the latter. Both these processes depend, first, upon the exposure of the wood to a temperature sufficient to destroy organic life; and, second, upon the well-known and unequaled preservative effects of carbolic and cresylic acids. These acids are soluble in water, and hence, if not protected against its action, will, sooner or later, be removed from a block. The filling or sealing of the pores, by some substance which is not liable to easily oxidize or volatilize, is absolutely necessary to secure the continued and complete protective agency of the alcohols contained in dead oil. The experiments show such protection to be afforded in cases numbered 4, 6, 7, 12, but not in Nos. 1, 10, 15, and 20, all of which possess high absorptive power. The vapor processes claim the deposition throughout wood, of the heavier hydrocarbons contained in dead oil. Blocks No. 4, 6, 7, 12, exhibit the shining flakes of naphthaline, &c., but none were observed in Nos. 10, 15, and 20. The high temperature at which these solids are converted into vapor, renders it doubtful if wood can be impregnated with them, from the vaporous state. Wood being a poor conductor of heat—(pine, 0.39 : water, 1,) large pieces cannot be uniformly raised to 500° F. without charring the exterior. If, by the Robbins' process, this temperature is employed, the strength of the fibre must be greatly diminished, and this effect was observed in the specimens of paving-blocks sent to the Laboratory. The limit of safety for pine wood is probably under 300° F. There is also a manifestly large waste of *work* by this process, and for this reason alone, any method which secures an equally thorough saturation by the whole oil, without the large expenditure of heat in vaporizing it, should be preferred.

The Seely process, by which so favorable results have been given in this investigation, is an improvement upon the old vacuum and pressure processes, in respect to the removal of sap and moisture from the wood. I have

myself observed the impossibility of removing any considerable percentage of water from wood by the use of the air-pump; while the direct application of an oil bath, heated to a point above 212° F., and continued for some hours, gave very satisfactory results. All the processes which use dead oil, possess an advantage which arises from the antiseptic and disinfectant character of the material. It may be justly claimed that, without proving offensive to the senses, pavements thus prepared will favorably affect the health of a city.

Respectfully submitted to the Surgeon-General, to accompany tabular statements and diagrams.

W. C. TILDEN.
A. A. Surgeon, U. S. A.

EXPERIMENTAL RESULTS.

Number and size of each block as received.	1 Absorptive power (per cent. of distilled water absorbed in 48 hours.)	2 Per cent. of solution and mechanical removal in the preceding experiment.	3 Per cent. of matters dissolved by the proper solvents from the centre of each block.	4 Per cent. dissolved from the superficial portions of each block.	5 Ash, per cent. at centre.	6 Ash, per cent. near the surface.	7 Apparent specific gravity at centre of each block.	8 Apparent specific gravity of superficial portions of each block.	9 Weight of one cubic foot of density of column 7.	10 Weight of one cubic foot of density expressed in column 8.	11 Reaction of the Wood.
1. 8x3x6 in.	per cent 24.29	per cent 1.00	per cent 4.55	per cent 33.8	per cent 1.72	per cent 13.6	0.412	0.568	lbs. 25.1	lbs. 35.5	Acid.
2. 8x8x4½ in.	47.90	0.21	2.34	7.7	1.86	6.2	0.443	0.472	27.6	29.5	Acid.
3. 2x6x1 in.	5.08	0.43	7.7	5.08	0.33	0.4	1.116	1.007	69.7	62.9	Acid.
4. 4x6x2 in.	7.25	0.39	35.4	40.00	2.1		0.707	0.700	44.1	43.7	Faintly Acid.
5. 4x4½x2 in.	46.64	1.01	2.64	9.55	1.63	7.2	0.619	0.6706	38.6	41.9	Faintly Acid.
6. 10x6x4 in.	3.32	0.16	centre & surface. 17.		0.35		0.5608	0.650	35.0	40.6	Faintly Acid.
7. 9x4x1 in.	8.46	0.33	centre & surface. 22.8		0.45		0.845		52.8		Faintly Acid.
8 6x6x3 in.	97.58	0.46	1.55	3.3	1.46	5.4	0.484	0.498	40.2	41.1	Faintly Acid.
9. 7x6½x5 in.	31.36	0.26	1.16	3.45	1.45	1.60	0.4609	0.439	28.8	27.4	Acid.
10. 12x6x3 in.	22.80	1.00	1.96	12.25	0.52		0.4202	0.445	26.2	27.8	Faintly Acid.
11. 12x6x4 in.	16.15	0.5	14.83	23.7	0.38		0.7005	0.833	43.7	52.0	Faintly Acid.
12. 12x7x4 in.	13.54	0.10	16.2	17.6	0.29		0.601	0.633	37.5	39.5	Faintly Acid.
13. 4x5x3 in.	2.88	0.13	35.07	41.4	0.36		1.095	1.064	68.4	66.5	Acid.
14. 6x3x2 in.	21.27	5.44	31.3	73.5	21.9	24.8	0.455		28.4		Acid.
15. 8x6x3 in.	23.19	0.23	10.8	13.4	0.52		0.6004	0.617	37.5	38.5	Faintly Acid.
16. 10x6x3 in.	29.11	0.59	1.91	7.5	1.8	3.8	0.449	0.554	28.0	34.6	Acid.
17. 10x6x3 in.	31.98	9.54	9.17	67.0	6.74	38.8	0.449	0.541	28.0	33.8	Neutral.
18. 5x4x3 in.	28.93	0.16					0.493		30.8		
19 5x4x3 in.	62.74	0.64									Acid.
20. 10x6x3 in.	78.10	0.21					0.429		26.8		
21.			1.57	4.7	1.63		0.519				
22. Small piece from a pavement in N. Y., laid three years.			35.				0.407		25.4 (very dry.)		

MINERAL & METALLIC PROCESSES.

Name and Number.	Brief of Claim.
Burnettized Spruce. Two specimens. Nos. 2 and 9. (No. 2 is a piece of railroad tie, said to have been buried sixteen years.)	"The Burnettizing process consists in placing the wood in large wrought iron cylinders; then extracting the air and sap contained in the pores of the wood by a vacuum. The solution of chloride of zinc is then allowed to run in, and a pressure of from 150 to 160 lbs. per square inch applied to force the zinc into the pores." Perfect coagulation of albumen and entire indestructibility by wet or dry rot are claimed.
A. B. Tripler's Arsenic Process. One specimen. No. 14.	Saturation of blocks composing a wooden pavement with chloride of arsenic, or arsenic and chloride of sodium, and coating them on their upper surface with a resinous or tarry waterproof composition. Also, the interposition of an antiseptic compound between the blocks and the earth, by either soaking the foundation planks or mixing the antiseptic with the sand.
The Samuel's Process. Nos. 8 and 5 (?).	"Injecting into the pores of the wood, first, a solution of of sulphate of iron, and afterwards a solution of common burnt lime, to render the wood in a high degree impervious to the influence of wet and dry rot, and the attacks of worms and other insects."
Thilmany's Process. One specimen. No. 16.	Saturation with sulphate of copper, followed by muriate of barytes, to form insoluble sulphate of barytes in the wood.
Process of Wirt and Hurdle. Specimens 18(a) and 18(b).	Charring the wood and covering the whole block with asphaltum.
Tait's Process. One specimen said to have been sent, marked No. 5. Analysis, however, places this block with No. 8, as a sample of the Samuel's process.	"Charging or saturating the pores of the wood with a concentrated solution of bi-sulphite of lime or baryta, the same being rendered soluble by excess of sulphuric acid gas, under pressure or by refrigeration, and being made insoluble as a neutral sulphate when the pressure or excess of gas is removed."
Thomas Taylor's Process. Two specimens. Nos. 19 & 21.	Uses a solution of sulphide of calcium in pyroligneous acid for the impregnation of the wood; or, uses sulphide of calcium first, and follows it with pyroligneous acid. Claims a deposit of pure sulphur through whole block.
Thompson & Co.'s Process. (Arsenic.) No. 17.	No description or explanation of process furnished. Claims "indestructibility" and "non-inflammability."

REMARKS.

Fibre of blocks weak and brittle ; color greyish.

Absorptive power greater than that of natural wood. All of the zinc easily removed by acidulated water. Evidences of the partial decomposition of the zinc chloride observed. Uneven character of impregnation shown both by microscopic examination and by unequal percentage of mineral matters removed by acidulated water from centre and near surface. (See Columns 3 and 4 of Experimental Results.)

Size of specimen very small, yet the impregnation uneven. (See Columns 3 and 4.) Quantities of soluble salts very large. No arsenic found, though its use is claimed. The resinous covering designed to protect the top of each block is worthless for the purpose, for obvious reasons, chiefly its brittleness.

Absorptive power high.

Absorptive power too high for representation on the chart. Wood brittle and readily splintered. Impregnation very unequal. The water used for Experiment No. 1 (absorptive), was filled with threads of fungi after standing forty-eight hours, showing that it is doubtful if even dry rot can be prevented by this process.

Saturation very uneven. Absorptive power high.

Block contains soluble salts of copper removable by washing.

Process inapplicable to unseasoned timber. The asphalt covering melts and flows at 60° to 70° F. When cold and brittle, the wear of the pavement will remove it, leaving each block as a porous cup for the reception of water which cannot drain through it. Process not considered worth particular investigation.

It is doubtful if any specimen was received. No. 5 resembles the "ironized" blocks. If claimed as a sample of the Tait process, the same memoranda are made upon it as upon No. 8.

The claims of this process are not substantiated.

No sulphur uncombined found in any part of blocks submitted.

About nine-tenths the whole bulk of each block possessed every property of seasoned white pine untreated by any method whatever.

Between three and four per cent. sulphate of lime found in superficial portions.

An arsenic process. Absorption power high. Specimen is cottonwood.

Saturation extremely uneven. Solubility of saline ingredients complete.

Creosote Oil and Resin Processes.

Laboratory, Surgeon-General's Office.

Name and Number.	Brief of Claim.	Remarks.
Waterbury's Process. One Specimen. No. 1.	Treats wood in closed cylinder with steam to vaporize sap; then introduces a solution of *common salt*, followed by *dead oil*, *creosote oil* or equivalent. Claims complete impregnation by both substances.	Absorption figures high. Saturation by solution of common salt is only partial. Columns 3 and 4, show a very uneven penetration by "*dead oil.*" Water dissolves out all the salt used. Columns 5 and 6, show the uneven distribution of mineral matters.
Thomas' Process. Two Specimens. Nos. 3 and 13.	Two small blocks, 2x6x1 and 4x5x3 in., were sent without explanation or name; the substance used for impregnation is "resin oil."	Absorption power low. Physical condition of specimens very bad. Saturating material easily soluble in alkaline fluids. The strength of wood in these samples stands at a minimum, especially its traverse and crushing strength.
Seely's Process. Five Specimens. **Pelton's Apparatus.** for applying Seely Process. Nos. 4, 6, 7, 12, 22.	Immersion of wood in a bath of *creosote oil* or other suitable material, heated to about 250° F., until it is evident that air and moisture are eliminated; then substituting for the hot bath, one at as low a temperature as allows perfect fluidity, the liquor being also *dead oil.* Claims that the pores of the wood are in a vacuous condition as it cools, and that the impregnating material readily fills them by capillary action and atmospheric pressure.	Average absorption power very low. Saturation thorough and very uniform. (See Columns 3, 4, 9 and 10.) Solid hydrocarbons present within the cells. Condition of fibre uninjured.
Robbins' Process. Two Specimens. Nos. 10 and 20.	Claims to impregnate wood with *light and heavy oils of tar*, by exposure in a chamber connected with a *retort* or *still* in which the oils are *vaporized*; states that naphthalin and other solid hydrocarbon bodies are distilled over into the wood and condensed in its pores; also that all moisture is driven out and the albumen coagulated.	Absorption power very high. Per centage of liquid hydrocarbons very low in all portions of block except the outer. No solid hydrocarbons observed, even on surface (naphthalin, &c.) Condition of wood shows injury from heat. Specimens are evidently suited for exposure to *dry air* only, under which circumstances the protection is sufficient.
Detwiler and Van Gilder Process. No. 11.	Impregnation of wood by *resin* dissolved in *naphtha*, under pressure, and at high temperature.	Saturation uneven. (Columns 3 and 4, also 9 and 10.) Absorption power quite high.
U. S. Antiseptic W od Co.'s Process. Constant and Smith Patents. No. 15.	*Dries* or *seasons* wood by *hot air;* preserves it, (when desired), by generating "*smoky vapors*" in a retort, the same being allowed to penetrate the wood and to condense within its pores.	The same remarks made under Nos. 10 and 20 (Robbins' process), apply to this specimen, with the difference that, the experimental results show the Robbins process to be very much superior to this, which presents identical claims.